WORK PLAN FOR
REMEDIAL EXCAVATION ACTIVITIES
AOI 5

PHILADELPHIA ENERGY SOLUTIONS FACILITY
PHILADELPHIA, PENNSYLVANIA

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC
2 Righter Parkway, Suite 200
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February 11, 2014
2574602

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1.0 INTRODUCTION

The Current Conditions Report and Comprehensive Remedial Plan (CCR) prepared by Sunoco Inc. (R&M) (Sunoco), dated June 30, 2004, proposed Phase II site characterization and corrective action activities for Sunoco's Philadelphia Refinery (Refinery), including preparation of site characterization reports for individual Areas of Interest (AOIs). The CCR presented a prioritization of all eleven AOIs based on specific risk factors.

Sunoco submitted a Site Characterization Report/Remedial Investigation Report/Cleanup Plan (SCR/RIR/CUP) for AOI 5 on December 13, 2011 to the Pennsylvania Environmental Protection Agency (PADEP) and United States Environmental Protection Agency (EPA) Region III. That report summarized the site characterization work completed between 2007 and 2011, as well as proposed remedial and cleanup activities for AOI 5 based on the characterization. This SCR/RIR/CUP was submitted to the PADEP and the EPA in accordance with Sunoco's Work Plan for Sitewide Approach under the One Cleanup Program (Sitewide Approach Work Plan), dated September 16, 2011. The PADEP responded to the submittal of the SCR/RIR/CUP with a comment letter on July 25, 2012, stating the issues that need to be addressed in order for Sunoco to obtain a release of liability under the Act 2 Program.

Since the submittal of the SCR/RIR/CUP in 2011, Sunoco sold the Philadelphia Refinery to Philadelphia Energy Solutions Refining and Marketing LLC (PES). The sale of the facility was done under a Buyer Seller Agreement signed by Sunoco, PES and the PADEP in September 2012 (BSA).

At the end of December 2013, Sunoco Inc. created Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC, part of a wholly owned subsidiary of Sunoco, Inc., to manage all legacy remediation liabilities at the PES facility moving forward. With regard to the PES Refinery, Evergreen personnel will work with PADEP, EPA and PES personnel to fulfill the obligations set forth in the 2011 Sitewide Approach Work Plan and the 2012 BSA.

This Work Plan for Remedial Excavation Activities (Work Plan) has been prepared for AOI 5, also known as the Girard Point South Tank Field Area, at the PES Refinery.

1.1 Objectives

The objective of this Work Plan is to define the scope of planned soil remedial excavation activities to be conducted by Evergreen in AOI 5 of the PES facility. The

purpose of the excavations is to remove leaded tank bottom materials from two places in Solid Waste Management Units 93 and 94 (leaded tank bottom SWMUs), and soil with lead concentrations above the current site-specific standard (SSS) of 1,708 milligrams per kilogram (mg/kg). There are nine proposed soil excavation areas total; these areas are shown in Figure 1. Each area was delineated as part of the AOI 5 site characterization activities completed by Sunoco, Inc. The soil excavation activities and results will be summarized in a Cleanup Plan for AOI 5.

2.0 PROPOSED REMEDIATION ACTIVITIES

The following tasks are proposed as part of this Work Plan:

Task 1: Review and Assessment of Historic Data
Task 2: Health and Safety Plan Preparation
Task 3: Excavation Limits Survey
Task 4: Soil Excavation
Task 5: Post-Excavation Sampling
Task 6: Sample Locations and Excavation Limits Surveying
Task 7: Backfilling Excavations
Task 8: Stockpiling and Sampling
Task 9: Data Evaluation
Task 10: Reporting

The tasks are discussed in detail in the following sections.

2.1 Task 1: Review and Assessment of Historic Data

Langan reviewed and assessed historical data pertaining to soil conditions at AOI 5, including the soil investigations completed between 2007 and 2013. These investigations characterized soil conditions inside SWMUs 93, 94, and 101, as well as outside the SWMU areas. Based on the characterization activities, two areas of confirmed leaded tank bottom materials exist – one within SWMU 93 and one within SWMU 94 (Figure 1). These areas were delineated with regard to the presence of leaded tank bottom materials and the delineation defines the extent of proposed excavation at these locations. Outside of the SMWU areas, seven areas exist where

lead concentrations are above the current SSS for lead. The extent of lead concentrations above the SSS was used to delineate the areas and define the limits of proposed excavation.

2.2 Task 2: Health and Safety Plan Preparation

Langan will prepare a Site-Specific Health and Safety Plan (HASP) for the proposed remedial excavation activities in accordance with our Corporate Health & Safety Program and Occupational Safety and Health Administration (OSHA) regulations (29 CFR §1910.120). The plan will reflect the proposed site activities, the compounds of concern and site-specific health and safety considerations for the project. Langan's HASP will only cover work being done by Langan personnel and the Contractor is responsible for their own health and safety program and that of any subcontractors also.

In addition to Langan's HASP for the remedial activities, work will also be conducted in accordance with the PES Refinery work permit requirements and procedures governing work within the Refinery.

2.3 Task 3: Excavation Limits Survey

Langan surveyors will layout the limits of excavation for the nine proposed excavations shown in Figure 1. The limits of the excavations, as marked by the surveyors, will be used to guide the extent of excavation activities.

2.4 Task 4: Soil Excavation

All excavations will be completed using a front-end loader or backhoe and will be directed by a Langan site representative. Excavated material that is to be stockpiled for characterization sampling will be transported to the designated stockpile locations shown on Figure 1. Excavated material will be staged on and covered with 10 mil (min.) polyethylene sheeting. All stockpiled materials will be covered at the end of each work day and the polyethylene sheeting shall be anchored securely so that it will not be blown out of place. Silt fence or compost socks will be installed around the perimeter of the material stockpiles.

<u>Excavation of Leaded Tank Bottoms in SWMUs 93 and 94</u>

The first areas that will be excavated are areas in SWMU 93 and 94 where leaded tank

bottom materials were confirmed by characterization. These areas are shown in Insets 2 and 5 on Figure 1. The leaded tank bottom materials and surrounding soil at these locations will be excavated and disposed off-site as hazardous waste. Both excavations are anticipated to extend to a depth of 2 feet below ground surface (bgs). If suspected leaded tank bottom materials are observed during excavation activities, the excavation will extend either vertically or horizontally, as necessary, to include the materials.

Excavation of Soil Areas Outside of SWMUs

The remaining areas will be excavated and the material will be stockpiled and sampled in accordance with the 2013 PADEP-approved Onsite Soil Reuse Plan for the PES Refinery. The seven proposed excavation areas are shown in Insets 1, 2, 3 and 4 on Figure 1. All excavations will be excavated to a depth of 2 feet bgs and material will be stockpiled at the stockpile location shown in Figure 1 for subsequent characterization.

2.5 Task 5: Post-Excavation Sampling

Following excavation, Langan will collect post-excavation soil samples in the proposed locations displayed on Figure 1. To determine the number of post-excavation samples and sample locations, the PADEP's "Spreadsheet for Systematic Random Sampling" was utilized (refer to Appendix A and Section 2.4 below).

The number of post-excavation soil samples collected for each excavation area was determined in accordance with Act 2 regulations (25 PA Code 250.703) based on the volume of soil to be removed (i.e., 8 samples per 125 cubic yards of material removed or portion thereof). The locations of the post-excavation soil samples were randomly selected in general accordance with Act 2 regulations (25 PA Code 250.703.c) to ensure that a representative distribution of sampling points, both horizontally and vertically, were obtained.

Langan will collect eight post-excavation soil samples at each excavation location as shown on Figure 1 and as summarized on Table 1. The amount of post-excavation soil samples is based upon the volume of each excavation where all of the anticipated volumes to be excavated are below 125 cubic yards each.

The samples will be collected using either a stainless steel hand auger or trowel. All sampling equipment will be properly decontaminated prior to and between each sample

point. Additional sample collection information is provided in Appendix B. The samples will be collected in laboratory-provided bottleware and submitted to Accutest Laboratories for analysis of site constituents of concern (COCs). Additional samples will be collected and submitted for analysis as part of quality assurance/quality control (QA/QC) measures.

2.6 Task 6: Sample Locations and Excavation Limits Surveying

Following completion of the proposed excavations and post-excavation sampling, the extent of excavation, as well as location of each post-excavation sample location, will be surveyed using a hand-held global positioning system (GPS) device.

2.7 Task 7: Backfilling Excavations

The excavations displayed in Insets 1, 2, 3 and 5 on Figure 1 will be backfilled with either material that meets the PADEP clean fill definition or onsite material that is considered appropriate for use in accordance with the 2013 Onsite Soil Reuse Plan for the Refinery. The excavations shown in Inset 4 on Figure 1 will be backfilled with low-permeability material (i.e., clay) that meets the PADEP clean fill definition or is considered appropriate for use in accordance with the 2013 Onsite Soil Reuse Plan. In addition, a minimum of 12 inches of clean crushed stone will be placed on top of the low permeability materials. The contractor will use appropriate means and methods for excavation backfill activities as directed by the Langan site representative.

2.8 Task 8: Stockpile Sampling

Excavation Material from SWMUs 93 and 94

Soils excavated from known leaded tank bottom areas will be staged at the designated stockpile location shown in Figure 1 or will be direct-loaded into roll-off containers and prepared for off-site disposal as hazardous waste in accordance with applicable hazardous waste regulations.

Excavation Material from Areas Outside of SWMU Areas

Soil excavated from areas outside of the SWMUs will be staged at the designated stockpile area shown in Figure 1, and the material will be sampled and characterized for reuse or disposal in accordance with the 2013 Onsite Soil Reuse Plan for the Refinery. The total estimated volume of soil to be generated from the excavations is 207 cubic yards. The Onsite Soil Reuse Plan specifies the sampling protocol presented below for

soil stockpiles that are less than 1,000 cubic yards:

Eight grab samples will be collected for soil analysis. Two grab samples will be collected for volatile organic compound (VOC) analysis based on photoionization detector (PID) or visual observations. After the VOC samples are secured, the eight samples will be combined into 2 composite samples for semi-volatile organic compound (SVOC) and metals analysis. All samples will be transferred to laboratory supplied containers and preserved as appropriate for the analyses to be performed. In addition, two samples will be collected and submitted for analysis by the synthetic precipitation leaching procedure (SPLP).

Samples for VOC and SVOC analyses will be taken from a minimum of 18-24 inches below the surface of the stockpile. Metals samples will be collected using laboratory cleaned stainless steel trowels or augers from a depth of at least 6 inches below the surface of the stockpile. Sample collection information is provided in Appendix B.

2.9 Task 9: Data Evaluation

The post-excavation sample results will be screened against the appropriate PADEP non-residential soil MSCs and the current SSS for lead. The stockpile soil samples will be evaluated via the 2013 Onsite Soil Reuse Plan for the Refinery to determine if the soil can be re-used onsite or needs to be disposed off-site. The QA/QC samples will also be evaluated to ensure usable data results.

2.10 Task 10: Reporting

Information obtained from Tasks 1 through 9 will be incorporated into a Cleanup Plan for AOI 5. This Cleanup Plan will be submitted to the PADEP and EPA for review and approval. The report will include conclusions and recommendations for future site characterization and/or remedial activities, if any, and will request EPA issue a comfort letter for SWMUs 93 and 94.

3.0 IMPLEMENTATION SCHEDULE

Remedial activities described in this Work Plan are anticipated to begin in late February 2014 and will be completed by late March 2014. During implementation, if any significant deviations

are required from the proposed scope of work included in this Work Plan, the PADEP and EPA will be notified prior to implementation of any changes to the work scope.

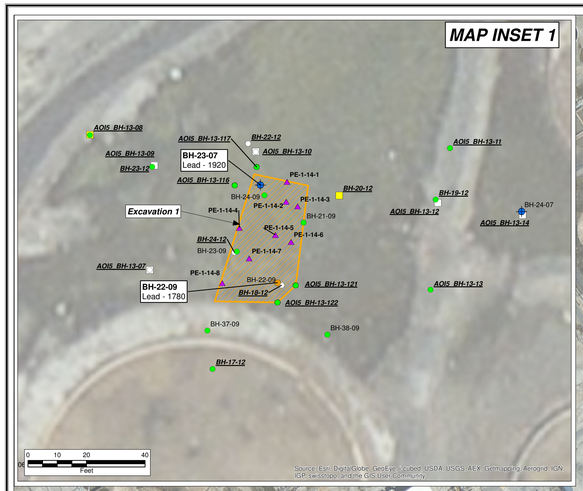
TABLES

Table 1
Summary of Proposed Excavation Activities
AOI 5 Work Plan
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Excavation	Approximate Area (sq. ft)	Approximate Depth (ft.)	Volume (cubic yards)	Location ID	Sample Media	Analysis	Objective of Proposed Activity
Excavation 1	950.93	2	70	PE-1-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-1-14-2	Soil	Site COCs	
				PE-1-14-3	Soil	Site COCs	
				PE-1-14-4	Soil	Site COCs	
				PE-1-14-5	Soil	Site COCs	
				PE-1-14-6	Soil	Site COCs	
				PE-1-14-7	Soil	Site COCs	
				PE-1-14-8	Soil	Site COCs	
Excavation 2a	1071.26	2	79	PE-2a-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-2a-14-2	Soil	Site COCs	
				PE-2a-14-3	Soil	Site COCs	
				PE-2a-14-4	Soil	Site COCs	
				PE-2a-14-5	Soil	Site COCs	
				PE-2a-14-6	Soil	Site COCs	
				PE-2a-14-7	Soil	Site COCs	
				PE-2a-14-8	Soil	Site COCs	
Excavation 2b	389.52	2	29	PE-2b-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-2b-14-2	Soil	Site COCs	
				PE-2b-14-3	Soil	Site COCs	
				PE-2b-14-4	Soil	Site COCs	
				PE-2b-14-5	Soil	Site COCs	
				PE-2b-14-6	Soil	Site COCs	
				PE-2b-14-7	Soil	Site COCs	
				PE-2b-14-8	Soil	Site COCs	
Excavation 3b	310.76	2	23	PE-3b-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-3b-14-2	Soil	Site COCs	
				PE-3b-14-3	Soil	Site COCs	
				PE-3b-14-4	Soil	Site COCs	
				PE-3b-14-5	Soil	Site COCs	
				PE-3b-14-6	Soil	Site COCs	
				PE-3b-14-7	Soil	Site COCs	
				PE-3b-14-8	Soil	Site COCs	
Excavation 3c	310.76	2	23	PE-3c-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-3c-14-2	Soil	Site COCs	
				PE-3c-14-3	Soil	Site COCs	
				PE-3c-14-4	Soil	Site COCs	
				PE-3c-14-5	Soil	Site COCs	
				PE-3c-14-6	Soil	Site COCs	
				PE-3c-14-7	Soil	Site COCs	
				PE-3c-14-8	Soil	Site COCs	
Excavation 4a	289.49	2	21	PE-4a-14-1	Soil	Site COCs	Remove soilswith lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-4a-14-2	Soil	Site COCs	
				PE-4a-14-3	Soil	Site COCs	
				PE-4a-14-4	Soil	Site COCs	
				PE-4a-14-5	Soil	Site COCs	
				PE-4a-14-6	Soil	Site COCs	
				PE-4a-14-7	Soil	Site COCs	
				PE-4a-14-8	Soil	Site COCs	
Excavation 4b	78.73	2	6	PE-4b-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-4b-14-2	Soil	Site COCs	
				PE-4b-14-3	Soil	Site COCs	
				PE-4b-14-4	Soil	Site COCs	
				PE-4b-14-5	Soil	Site COCs	
				PE-4b-14-6	Soil	Site COCs	
				PE-4b-14-7	Soil	Site COCs	
				PE-4b-14-8	Soil	Site COCs	
Excavation 4c	457.54	2	34	PE-4c-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-4c-14-2	Soil	Site COCs	
				PE-4c-14-3	Soil	Site COCs	
				PE-4c-14-4	Soil	Site COCs	
				PE-4c-14-5	Soil	Site COCs	
				PE-4c-14-6	Soil	Site COCs	
				PE-4c-14-7	Soil	Site COCs	
				PE-4c-14-8	Soil	Site COCs	
Excavation 5	310.76	2	23	PE-5-14-1	Soil	Site COCs	Remove soils with lead concentrations above site specific standard and conduct post-excavation soil sampling.
				PE-5-14-2	Soil	Site COCs	
				PE-5-14-3	Soil	Site COCs	
				PE-5-14-4	Soil	Site COCs	
				PE-5-14-5	Soil	Site COCs	
				PE-5-14-6	Soil	Site COCs	
				PE-5-14-7	Soil	Site COCs	
				PE-5-14-8	Soil	Site COCs	
Stockpile 1	NA	NA	206	SS1-14-1	Excavated Soil	VOC	Characterize excavated soils.
				SS1-14-2	Excavated Soil	VOC	
				SS1-14-3	Excavated Soil	SVOC	
				SS1-14-4	Excavated Soil	SVOC	
				SS1-14-5	Excavated Soil	Metals	
				SS1-14-6	Excavated Soil	Metals	
				SS1-14-7	Excavated Soil	SPLP	
				SS1-14-8	Excavated Soil	SPLP	

Notes:
1. Analysis of COCs listed in Table 1 of the 2011 AOI 5 SCR/RIR/Cleanup Plan.
2. Field procedures will be performed in accordance with Appendix B
3. Soil Stockpile 1 will be generated from excavated soils from Excavations 1, 2b, 3b, 3c, 4a, 4b, and 4c
4. Soil Stockpile 1 will be sampled in accordance with the 2013 Onsite Soil Reuse Plan
ft bgs = feet below ground surface

FIGURES



Legend

- Shallow Soil Boring Location with No Exceedance of Site Specific Standard for Lead
- Deep Soil Boring Location with No Exceedance of Site Specific Standard for Lead
- Proposed Shallow Soil Boring Location with No Sample (Due to Groundwater)
- Proposed Deep Soil Boring Location with No Sample (Due to Groundwater)
- Shallow Soil Boring Location with Exceedance of the Site Specific Standard for Lead (1,708 mg/kg)
- Deep Soil Boring Location with Exceedance of the Site Specific Standard for Lead (1,708 mg/kg)
- Soil Boring Location With Observed Leaded Tank Bottom Material
- Soil Boring Location With Documented Leaded Tank Bottom Material
- Proposed Post Excavation Sample Locations
- BH-01-07 — Soil Boring Completed Prior to 2012 RIR Addendum
- **BH-01-12** — Soil Boring Completed As Part of 2012/2013 RIR Addendum
- Shallow Monitoring Well Sampled
- Shallow Recovery Well Sampled
- Shallow Monitoring Well Location
- Deep Monitoring Well Location
- Shallow Recovery Well Location
- Damaged/Abandoned/Unable to Locate
- Sheet Pile Wall
- Solid Waste Management Unit (SWMU)
- Proposed Temporary Soil Stockpile Area
- AOI Boundary

Selected Remedy Key

- Areas 1, 2A, 2B, 3B, 3C and 5 - Excavation Area
- Area 3 - Asphalt Capped Area
- Area 4A, 4B and 4C - Excavation and Stone Backfill Area

Notes:
1. Boundary of SWMUs and sheet pile wall referenced from RCRA Facility Investigation Chevron Refinery Vol 1, Dames and Moore, 11-24-93.
2. Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Source of aerial imagery is Microsoft, 3/19/2011 (Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)
3. Historic soil sample locations referenced in the Aboveground Storage Tank Closure Assessment Report for GP 1209, 1210, and 1212 (Stantec, April 18, 2012), and the Aboveground Storage Tank GP-1208 Closure in Place Sampling Activities Report (Secor, Sept. 12, 2007).

Figure 1: Summary of Proposed Excavation Activities for AOI-5
PES Facility
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
PES Facility
3144 Passyunk Avenue
Philadelphia, PA.
19145

SCALE: See Map
DATE: February 10, 2014
DRN. BY: MH
CKD. BY: KM
JOB#: 2574601

0 120 240 Feet

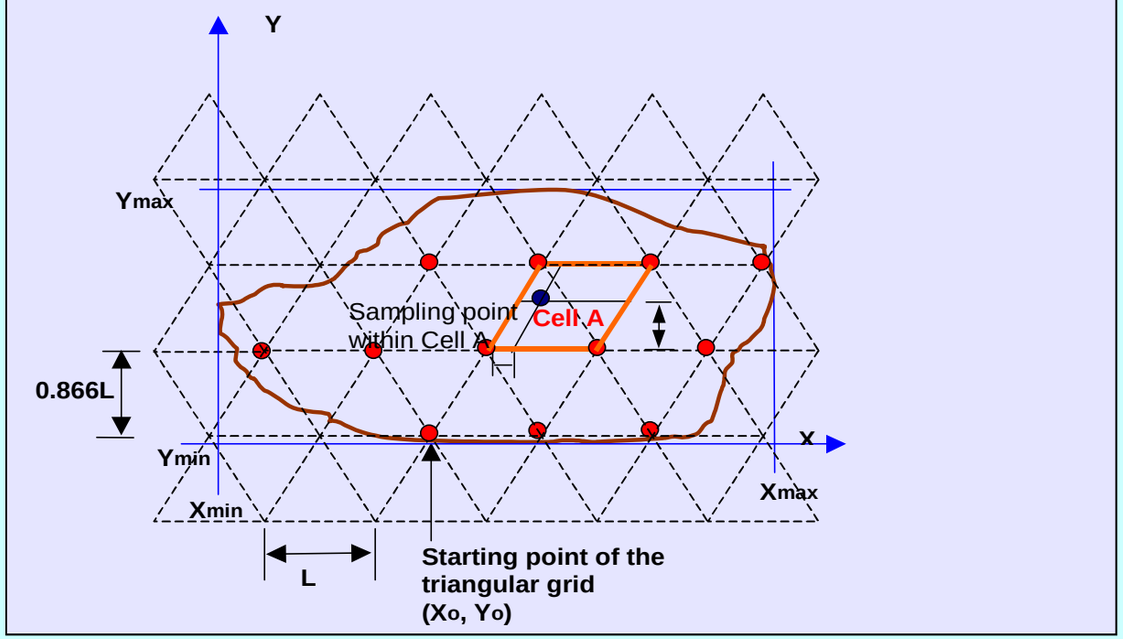
Document Path: I:\langan.com\data\DT\data5\2574601\ACAD\MapDocuments\AOI 5 PES Development\Figure 1 - Summary of Proposed Excavation Activities_2-10-14.mxd

APPENDICIES

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	950.93		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	70.44		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	11.7		
0.866*L(feet):	10.1		
Xmin (feet):	2682491		
Xmax (feet):	2682523		
Ymin (feet):	216820.4		
Ymax (feet):	216864.2		
Xo (feet):	#########		
Yo (feet):	216856.9		

Example

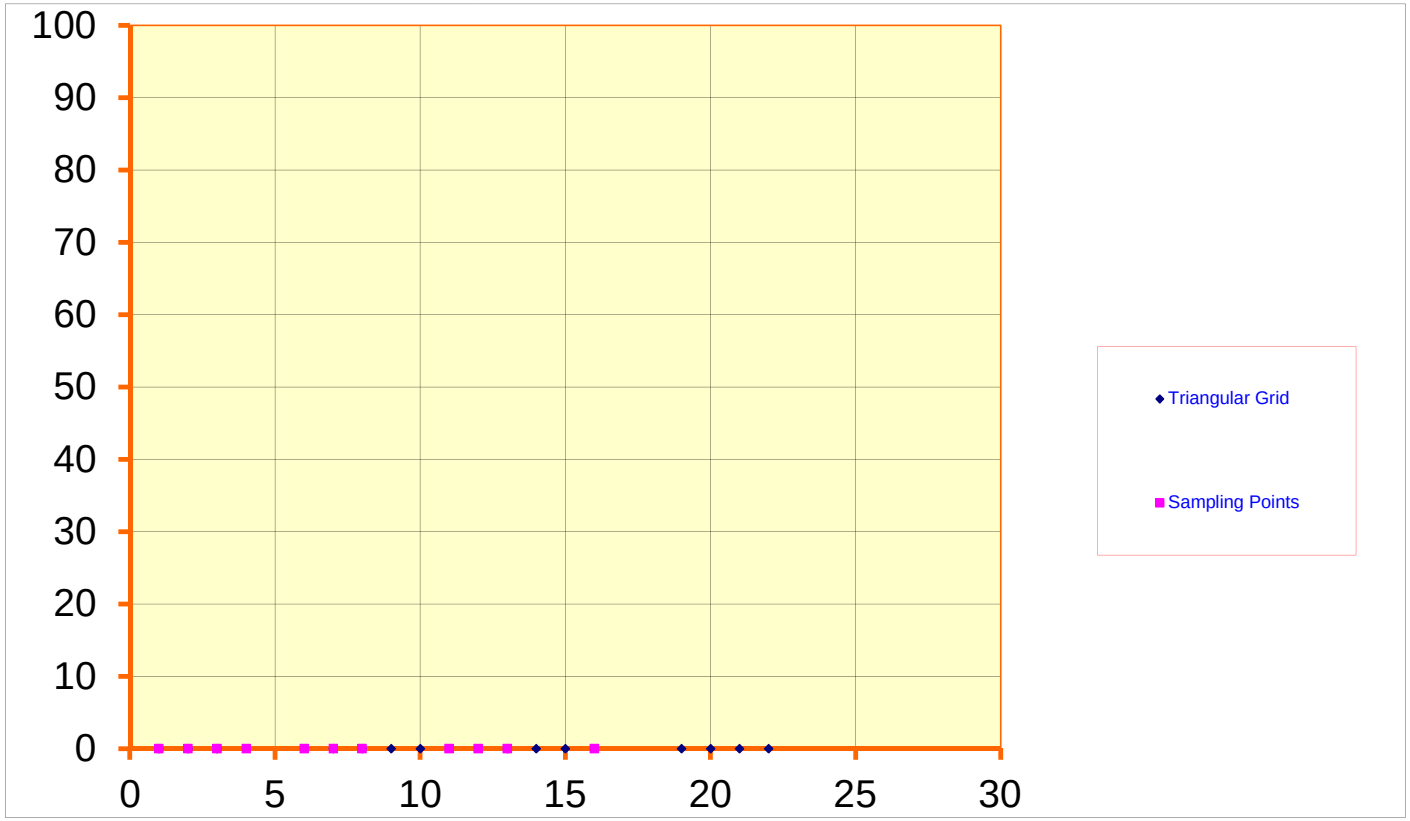


Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)	3rd Row (Xi, Yi)
	2682486 216856.9			
	2682497 216856.9			
Starting Point ---->	2682509 216856.9			
	2682521 216856.9			

-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)	-3rd Row (Xi, Yi)
2682491 216846.8	2682486 216836.7	2682491 216826.6
2682503 216846.8	2682497 216836.7	2682503 216826.6
2682515 216846.8	2682509 216836.7	2682515 216826.6
	2682521 216836.7	

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
You may need to hold the "Control" key to select multiple columns of data.



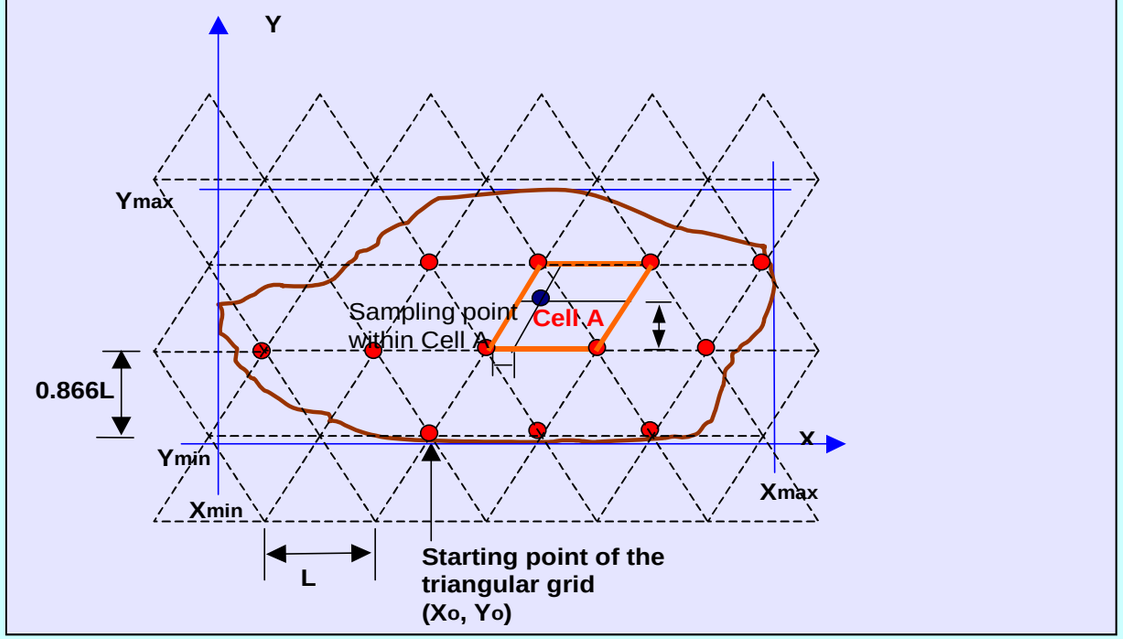
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			216816.5
-3			216826.6
-2	2682485.5	2682491.4	216836.7
-1	2682497.2	2682503.1	216846.8
0	2682508.9	2682514.8	216856.9
1	2682520.6		
2			
3			
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	1071.26		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	79.35		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	12.4		
0.866*L(feet):	10.7		
Xmin (feet):	2682396		
Xmax (feet):	2682425		
Ymin (feet):	216597.6		
Ymax (feet):	216657		
Xo (feet):	#########		
Yo (feet):	216609.8		

Example



Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)	3rd Row (Xi, Yi)	4th Row (Xi, Yi)
	2682387 216609.8	2682393 216620.5	2682387 216631.2	2682393 216641.9	2682387 216652.6
	2682399 216609.8	2682405 216620.5	2682399 216631.2	2682405 216641.9	2682399 216652.6
Starting Point ---->	2682412 216609.8	2682418 216620.5	2682412 216631.2	2682418 216641.9	2682412 216652.6
	2682424 216609.8		2682424 216631.2		2682424 216652.6

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)	-3rd Row (Xi, Yi)	-4th Row (Xi, Yi)
	2682393 216599.1	2682387 216588.4		
	2682405 216599.1	2682399 216588.4		
	2682418 216599.1	2682412 216588.4		
		2682424 216588.4		

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
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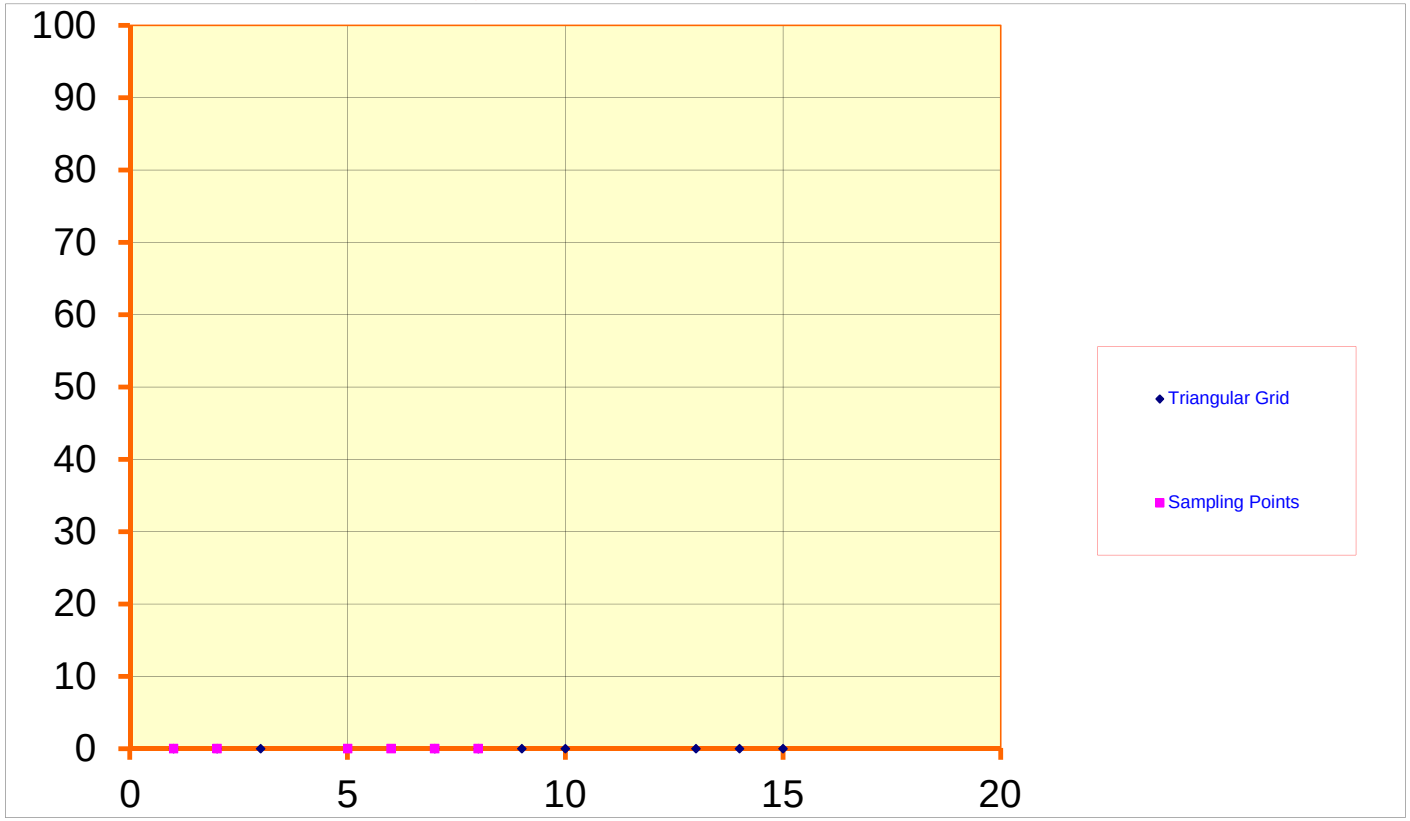


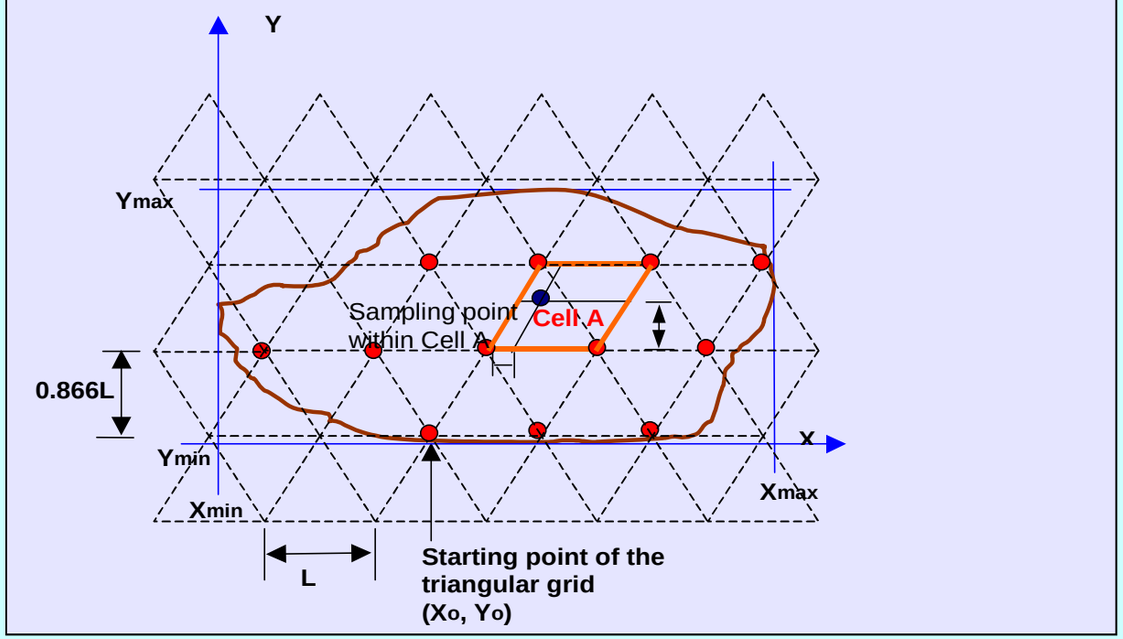
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3			
-2	2682386.7	2682392.9	216588.4
-1	2682399.1	2682405.3	216599.1
0	2682411.5	2682417.7	216609.8
1	2682423.9		216620.5
2			216631.2
3			216641.9
4			216652.6
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	389.52		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	28.85		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	7.5		
0.866*L(feet):	6.5		
Xmin (feet):	2682359		
Xmax (feet):	2682379		
Ymin (feet):	216627.4		
Ymax (feet):	216647.2		
Xo (feet):	#########		
Yo (feet):	216627.8		

Example

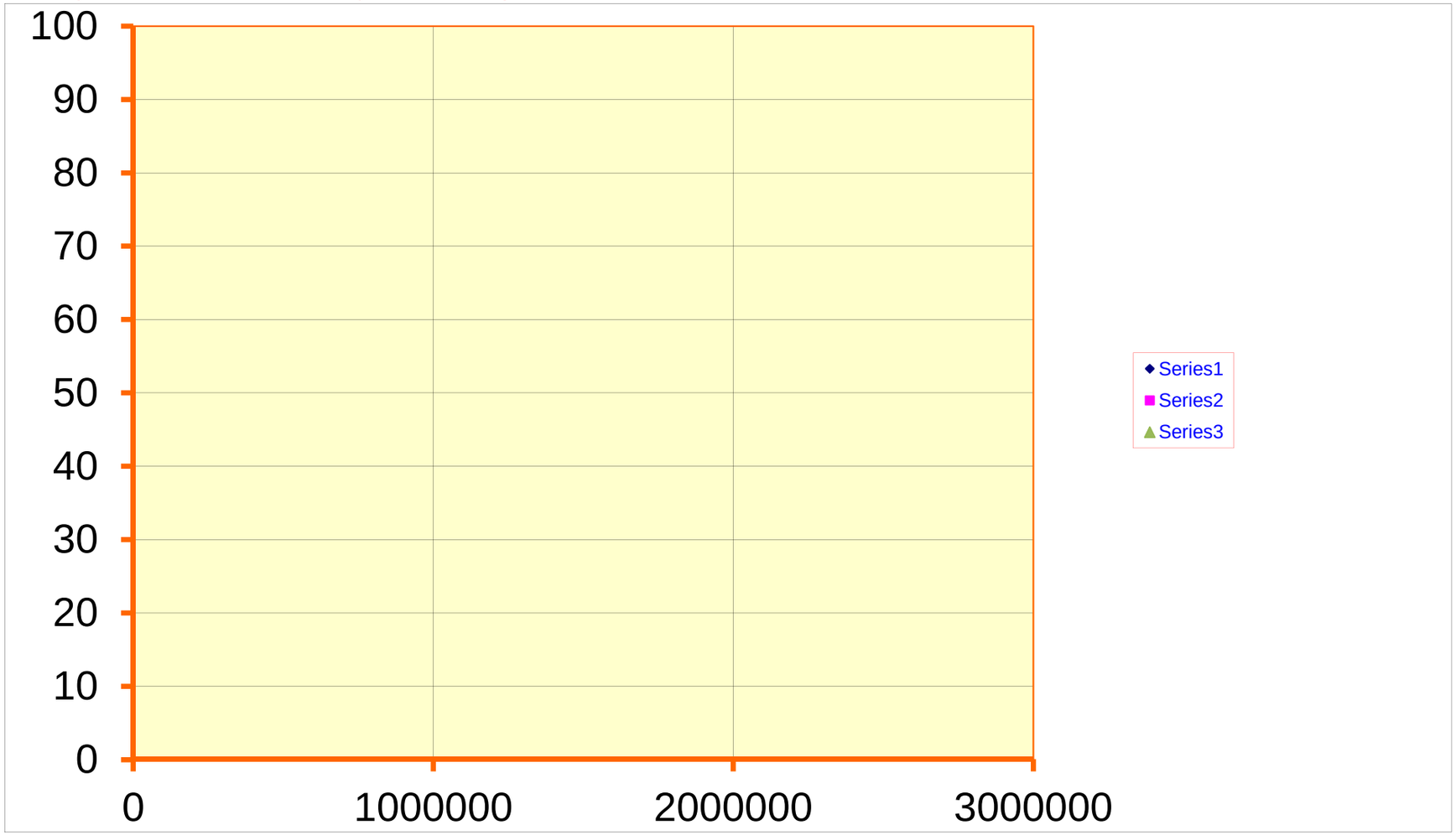


Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)
	2682356 216627.8	2682359 216634.3	2682356 216640.8
	2682363 216627.8	2682367 216634.3	2682363 216640.8
	2682371 216627.8	2682374 216634.3	2682371 216640.8
Starting Point ---->	2682378 216627.8		2682378 216640.8

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)
	2682359 216621.3	
	2682367 216621.3	
	2682374 216621.3	

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
You may need to hold the "Control" key to select multiple columns of data.



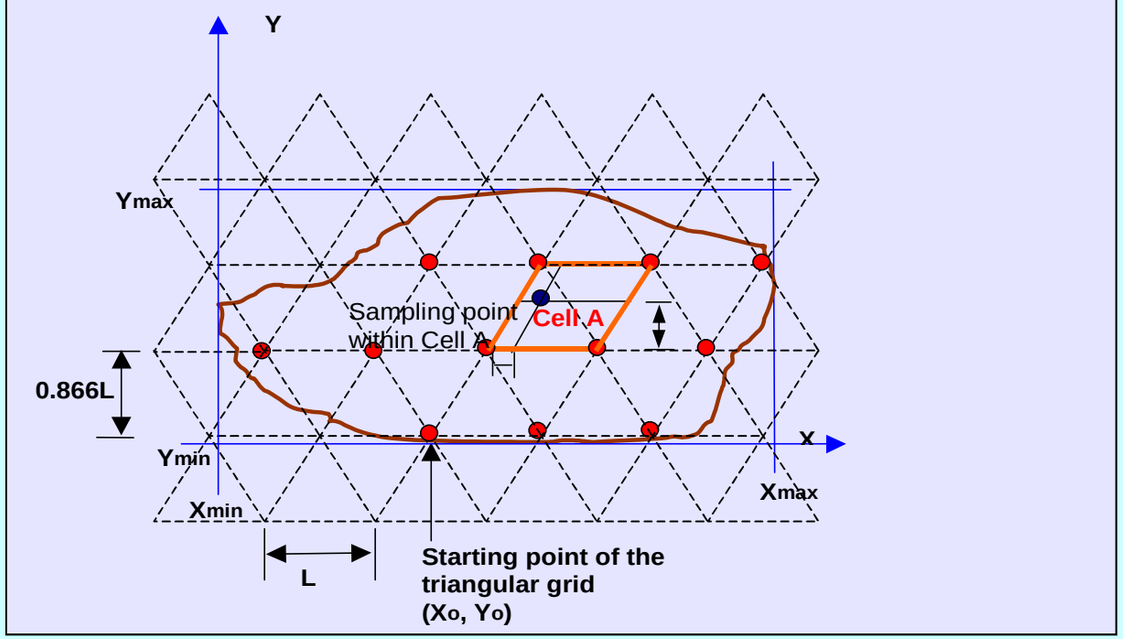
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3	2682355.6	2682359.4	
-2	2682363.1	2682366.9	
-1	2682370.6	2682374.4	216621.3
0	2682378.1		216627.8
1			216634.3
2			216640.8
3			
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	310.76		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	23.02		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	6.7		
0.866*L(feet):	5.8		
Xmin (feet):	2683210		
Xmax (feet):	2683231		
Ymin (feet):	215007.5		
Ymax (feet):	215022.7		
Xo (feet):	#########		
Yo (feet):	215014.4		

Example

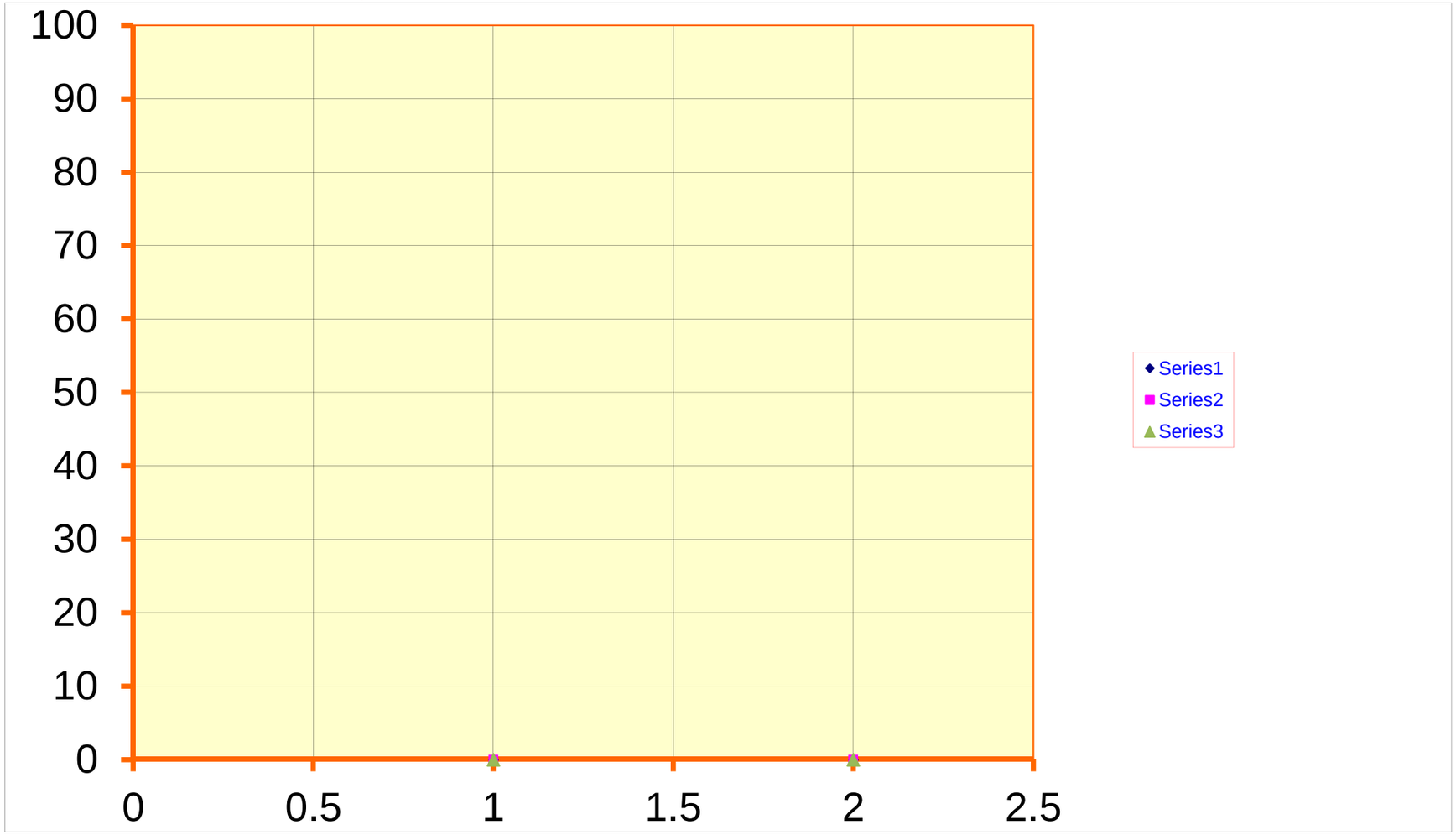


Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)
		2683207 215020.2	
	2683210 215014.4	2683214 215020.2	
	2683217 215014.4	2683220 215020.2	
Starting Point ---->	2683224 215014.4	2683227 215020.2	
	2683230 215014.4		

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)
	2683207 215008.6	
	2683214 215008.6	2683210 215002.8
	2683220 215008.6	2683217 215002.8
	2683227 215008.6	2683224 215002.8
		2683230 215002.8

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
You may need to hold the "Control" key to select multiple columns of data.



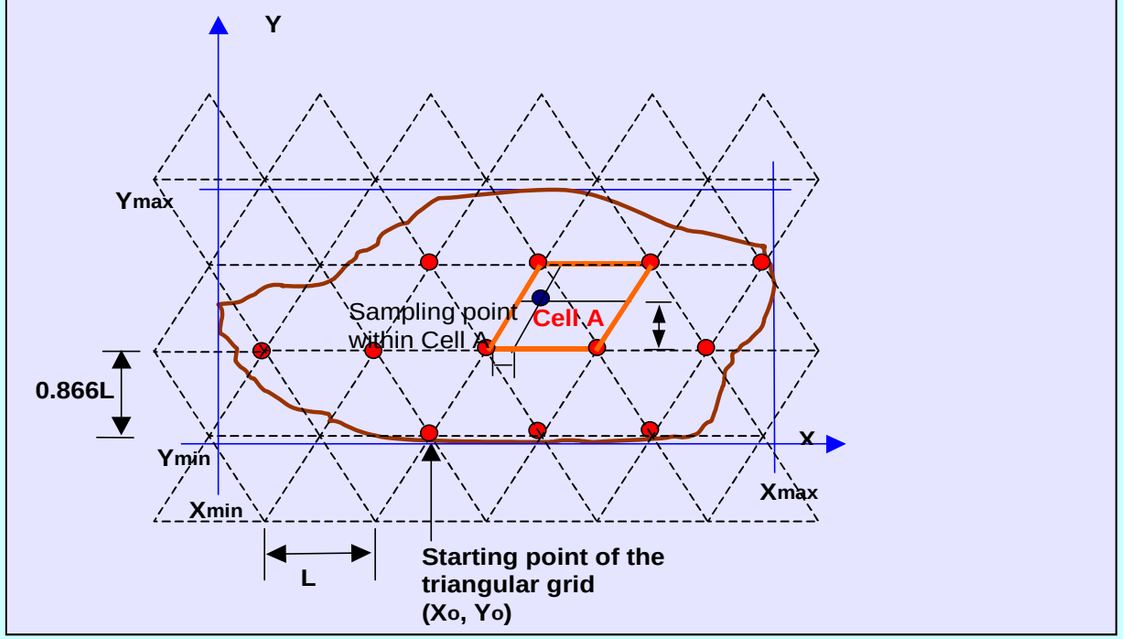
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3		2683206.9	
-2	2683210.2	2683213.6	215002.8
-1	2683216.9	2683220.3	215008.6
0	2683223.6	2683227.0	215014.4
1	2683230.3		215020.2
2			
3			
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	310.76		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	23.02		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	6.7		
0.866*L(feet):	5.8		
Xmin (feet):	2683200		
Xmax (feet):	2683220		
Ymin (feet):	214966		
Ymax (feet):	214981.2		
Xo (feet):	#########		
Yo (feet):	214977.3		

Example



Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)
	2683196 214977.3		
Starting Point ---->	2683203 214977.3		
	2683209 214977.3		
	2683216 214977.3		

-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)
2683199 214971.5	2683196 214965.7
2683206 214971.5	2683203 214965.7
2683213 214971.5	2683209 214965.7
2683219 214971.5	2683216 214965.7

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
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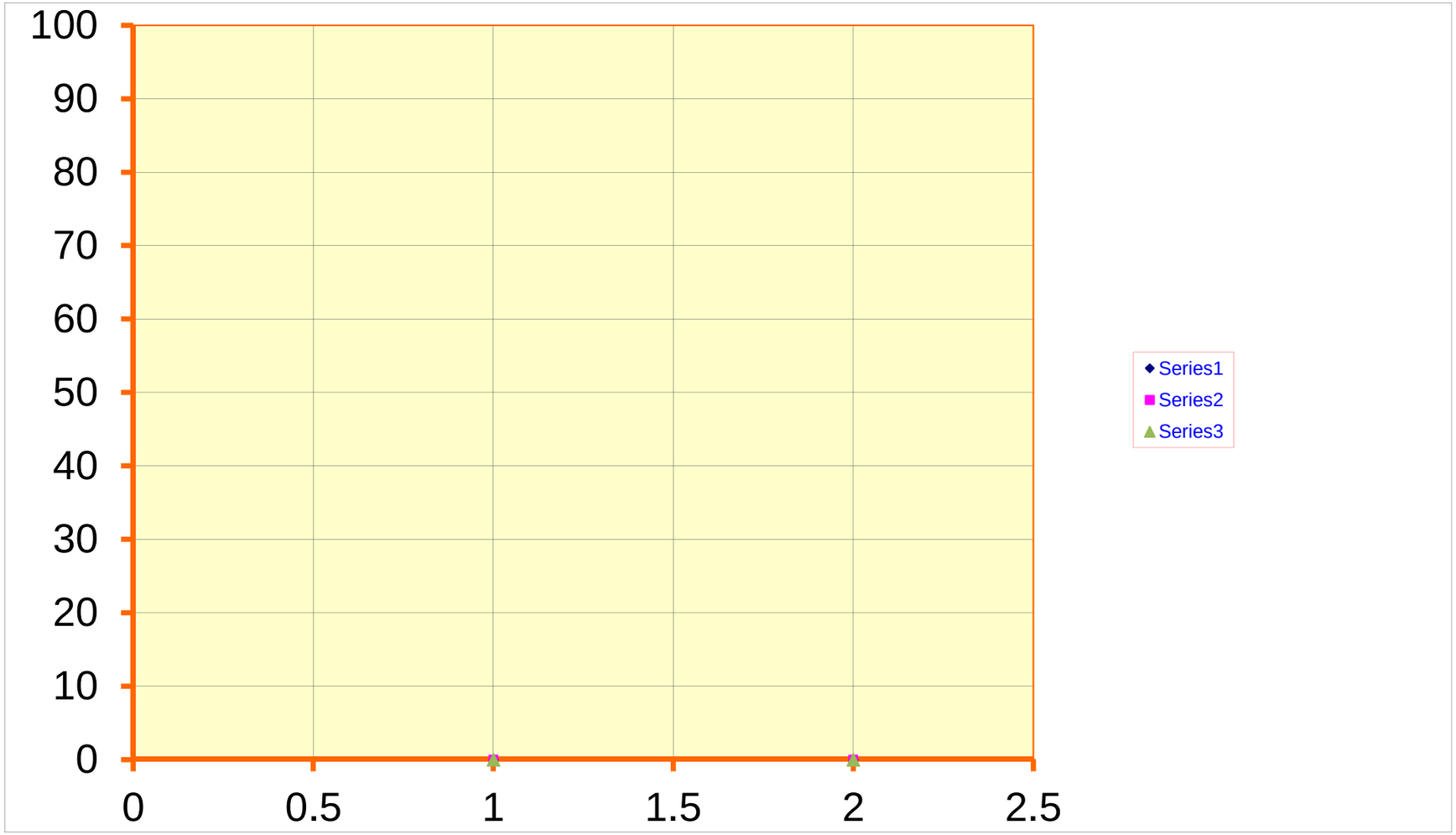


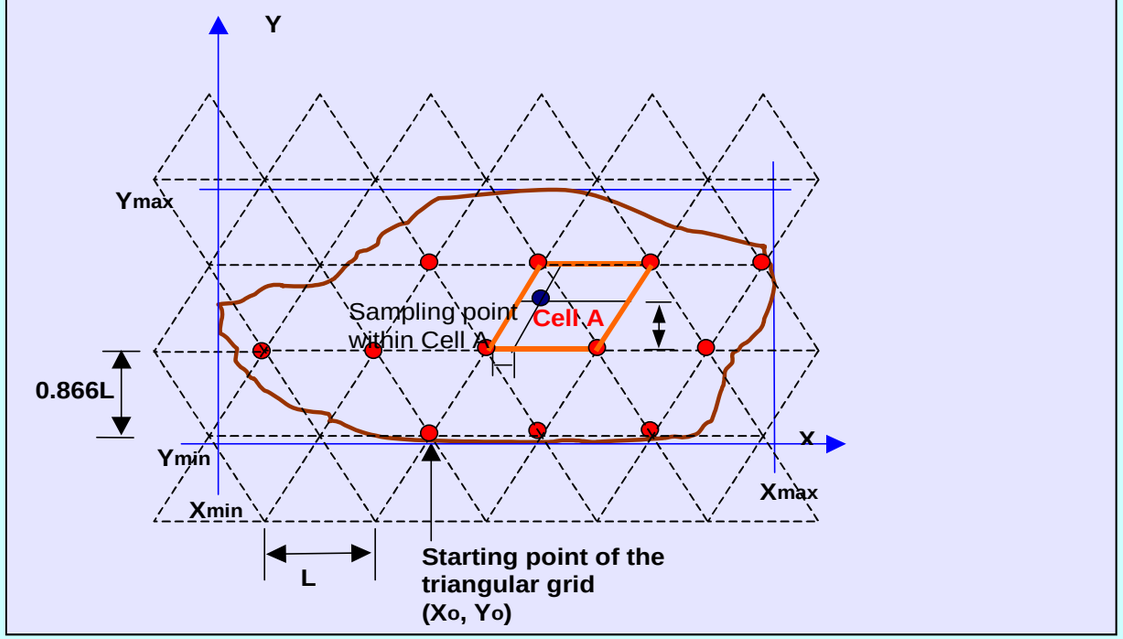
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3			
-2			214965.7
-1	2683196.0	2683199.4	214971.5
0	2683202.7	2683206.1	214977.3
1	2683209.4	2683212.8	
2	2683216.1	2683219.5	
3			
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	289.49		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	21.44		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	6.5		
0.866*L(feet):	5.6		
Xmin (feet):	2683679		
Xmax (feet):	2683707		
Ymin (feet):	215631.5		
Ymax (feet):	215660.6		
Xo (feet):	#########		
Yo (feet):	215647.0		

Example

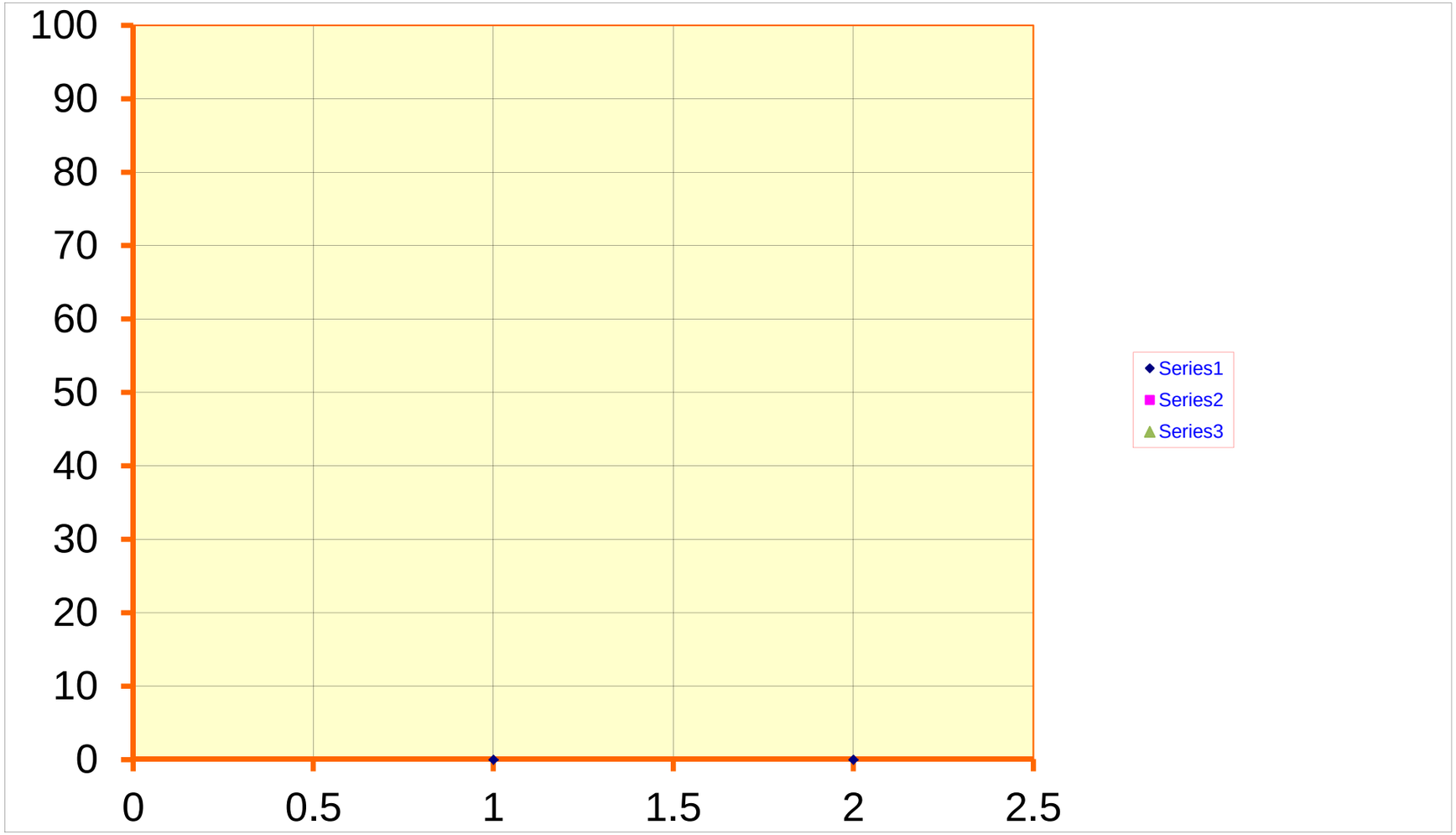


Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)		1st Row (Xi, Yi)		2nd Row (Xi, Yi)		3rd Row (Xi, Yi)	
			2683675	215652.6				
	2683678	215647	2683681	215652.6	2683678	215658.2		
Starting Point ---->	2683684	215647	2683688	215652.6	2683684	215658.2		
	2683691	215647	2683694	215652.6	2683691	215658.2		
	2683697	215647	2683701	215652.6	2683697	215658.2		
	2683704	215647			2683704	215658.2		

	-1st Row (Xi, Yi)		-2nd Row (Xi, Yi)		-3rd Row (Xi, Yi)	
	2683675	215641.4			2683675	215630.2
	2683681	215641.4	2683678	215635.8	2683681	215630.2
	2683688	215641.4	2683684	215635.8	2683688	215630.2
	2683694	215641.4	2683691	215635.8	2683694	215630.2
	2683701	215641.4	2683697	215635.8	2683701	215630.2
			2683704	215635.8		

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
Select 'Series' tab. Click collapse dialog buttons at the right end of X Values and Y Values boxes to adjust for the appropriate ranges of source data.
You may need to hold the "Control" key to select multiple columns of data.



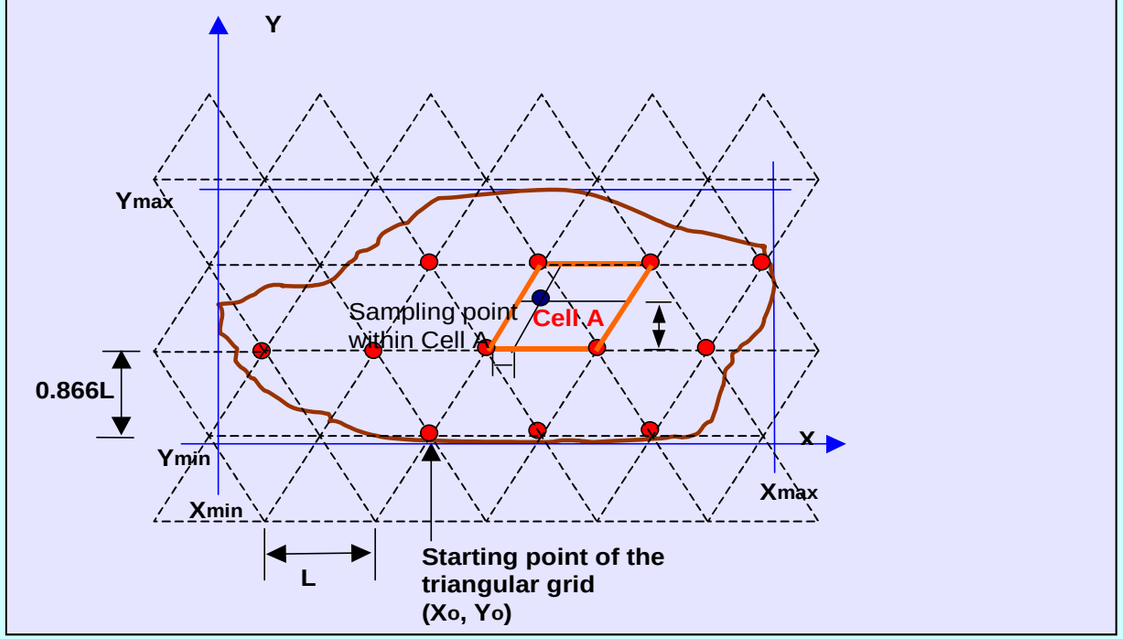
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3			215630.2
-2		2683674.6	215635.8
-1	2683677.8	2683681.1	215641.4
0	2683684.3	2683687.6	215647.0
1	2683690.8	2683694.1	215652.6
2	2683697.3	2683700.6	215658.2
3	2683703.8		
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	78.73		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	5.83		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	3.4		
0.866*L(feet):	2.9		
Xmin (feet):	2683627		
Xmax (feet):	2683645		
Ymin (feet):	215802.7		
Ymax (feet):	215813.1		
Xo (feet):	#########		
Yo (feet):	215806.4		

Example



Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)
	2683625 215806.4	2683626 215809.3	2683625 215812.2
	2683628 215806.4	2683630 215809.3	2683628 215812.2
Starting Point ---->	2683632 215806.4	2683633 215809.3	2683632 215812.2
	2683635 215806.4	2683637 215809.3	2683635 215812.2
	2683638 215806.4	2683640 215809.3	2683638 215812.2
	2683642 215806.4	2683643 215809.3	2683642 215812.2

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)
	2683626 215803.5	2683625 215800.6
	2683630 215803.5	2683628 215800.6
	2683633 215803.5	2683632 215800.6
	2683637 215803.5	2683635 215800.6
	2683640 215803.5	2683638 215800.6
	2683643 215803.5	2683642 215800.6

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
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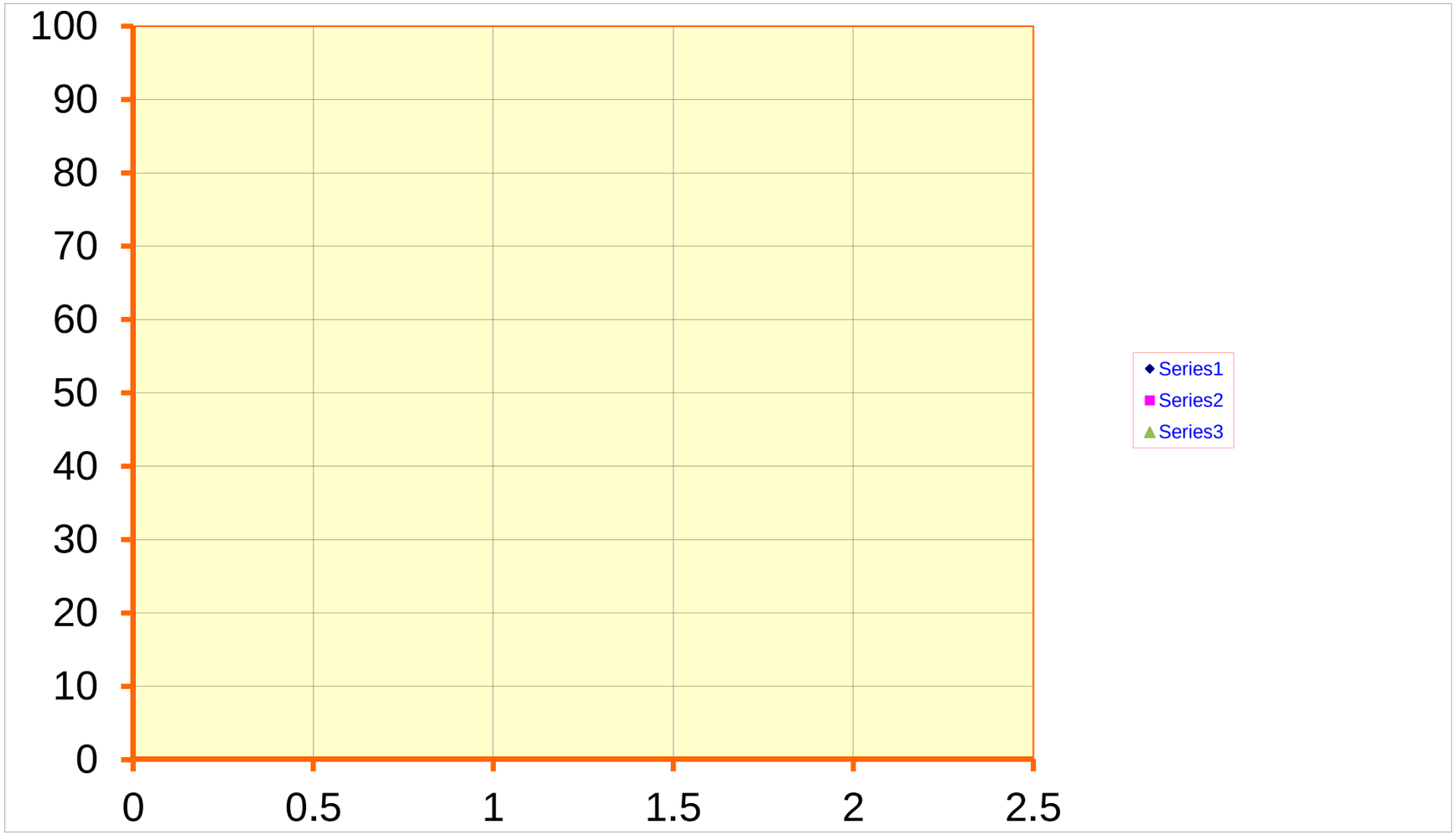


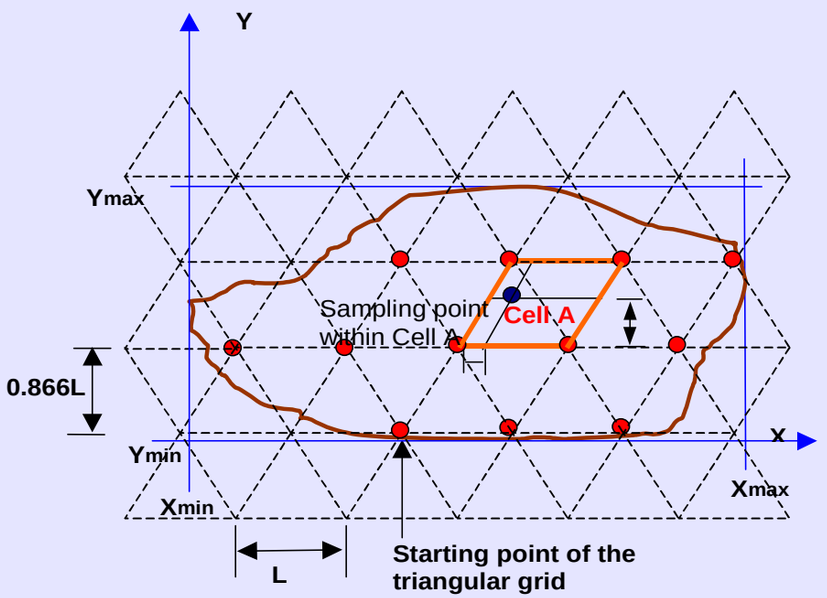
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3			
-2	2683624.7	2683626.4	215800.6
-1	2683628.1	2683629.8	215803.5
0	2683631.5	2683633.2	215806.4
1	2683634.9	2683636.6	215809.3
2	2683638.3	2683640.0	215812.2
3	2683641.7	2683643.4	
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	457.54		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	33.89		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	8.1		
0.866*L(feet):	7.0		
Xmin (feet):	2683561		
Xmax (feet):	2683595		
Ymin (feet):	215542.7		
Ymax (feet):	215571.1		
Xo (feet):	#########		
Yo (feet):	215553.7		

Example



Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)
	2683555 215553.7	2683559 215560.7	2683555 215567.7
	2683563 215553.7	2683567 215560.7	2683563 215567.7
	2683571 215553.7	2683575 215560.7	2683571 215567.7
	2683579 215553.7	2683583 215560.7	2683579 215567.7
Starting Point ---->	2683587 215553.7	2683591 215560.7	2683587 215567.7

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)
	2683559 215546.7	2683555 215539.7
	2683567 215546.7	2683563 215539.7
	2683575 215546.7	2683571 215539.7
	2683583 215546.7	2683579 215539.7
	2683591 215546.7	2683587 215539.7

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
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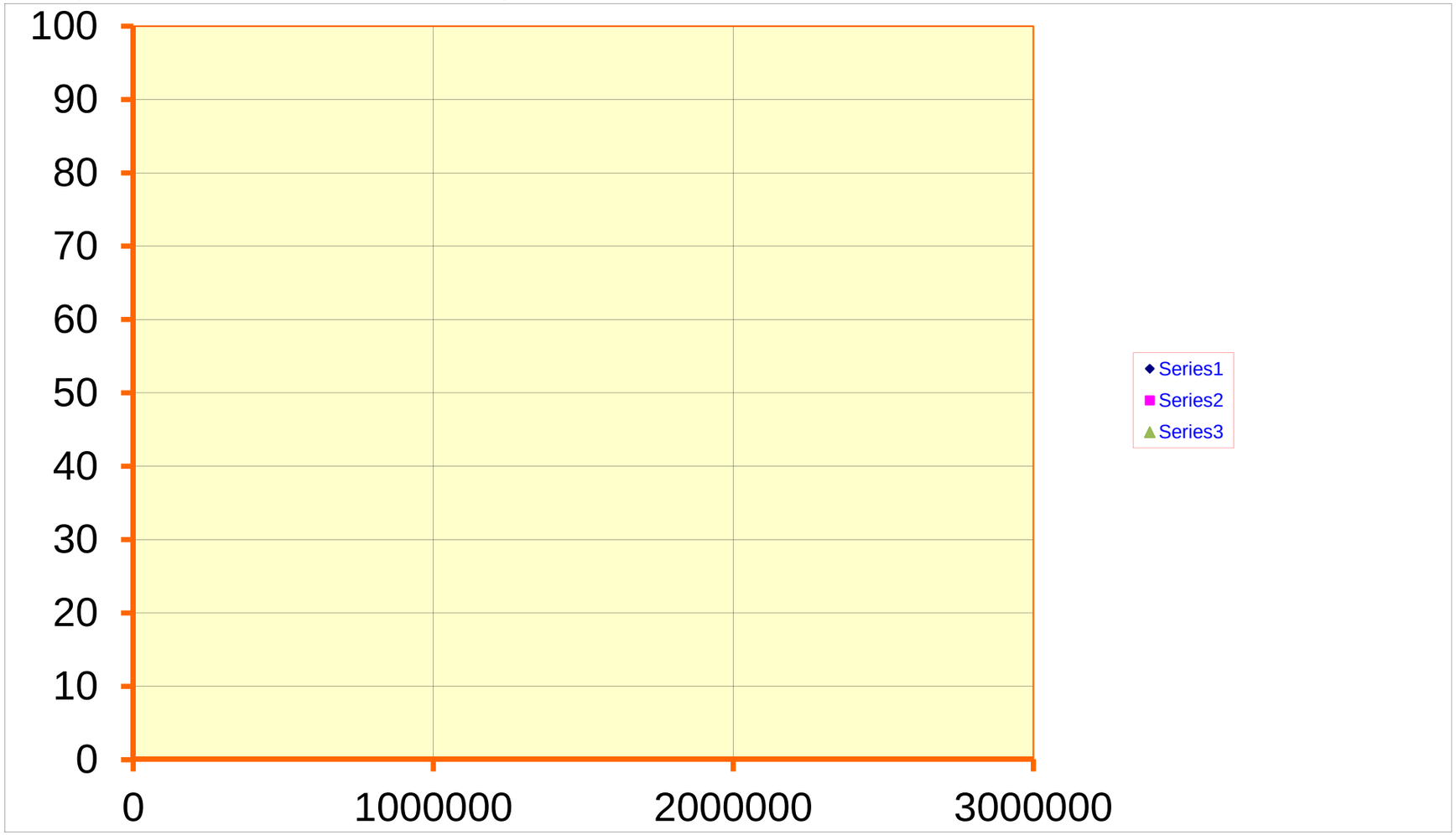
You may need to hold the "Control" key to select multiple columns of data.



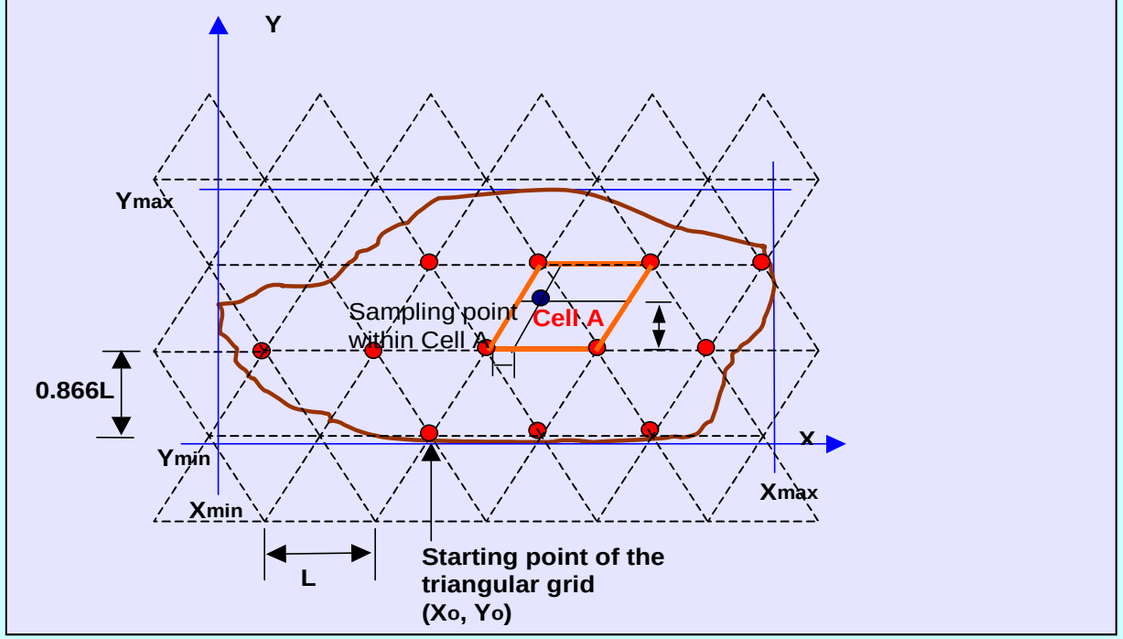
Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4	2683554.5	2683558.6	
-3	2683562.6	2683566.7	
-2	2683570.7	2683574.8	215539.7
-1	2683578.8	2683582.9	215546.7
0	2683586.9	2683591.0	215553.7
1			215560.7
2			215567.7
3			
4			
5			
6			
7			
8			
9			
10			

Systematic Random Sampling Workbook

Area of Contamination (Sq. feet.):	310.76		
Depth Zone (feet.):	0	-	2
Volume of Contaminated Soil (Cubic Yards):	23.02		
Number of Soil Samples: (If you are applying 75%/10X or 75%/2X rule, the spreadsheet will determine the minimum number of samples for you. Otherwise, please specify the number of samples here. **Limitations: The maximum number of samples per row is ten. The maximum number of rows is ten.**======>)			
Number of Soil Samples:	8		
L= Cell Spacing (feet):	6.7		
0.866*L(feet):	5.8		
Xmin (feet):	2683119		
Xmax (feet):	2683134		
Ymin (feet):	216038		
Ymax (feet):	216058.5		
Xo (feet):	#########		
Yo (feet):	216042.4		

Example



Triangular Grid Node Coordinate Pairs

	0th Row (Xi, Yi)	1st Row (Xi, Yi)	2nd Row (Xi, Yi)	3rd Row (Xi, Yi)
	2683114 216042.4	2683117 216048.2	2683114 216054	
Starting Point ---->	2683120 216042.4	2683124 216048.2	2683120 216054	
	2683127 216042.4	2683130 216048.2	2683127 216054	
	2683134 216042.4		2683134 216054	

	-1st Row (Xi, Yi)	-2nd Row (Xi, Yi)	-3rd Row (Xi, Yi)
	2683117 216036.6		
	2683124 216036.6		
	2683130 216036.6		

Note: The 'Source Data' may need to be adjusted manually in order to allow the triangular grid pattern and sampling points to appear.
Move the mouse pointer to the center of the plot area and then right-click the mouse. Select 'Source Data' from the menu.
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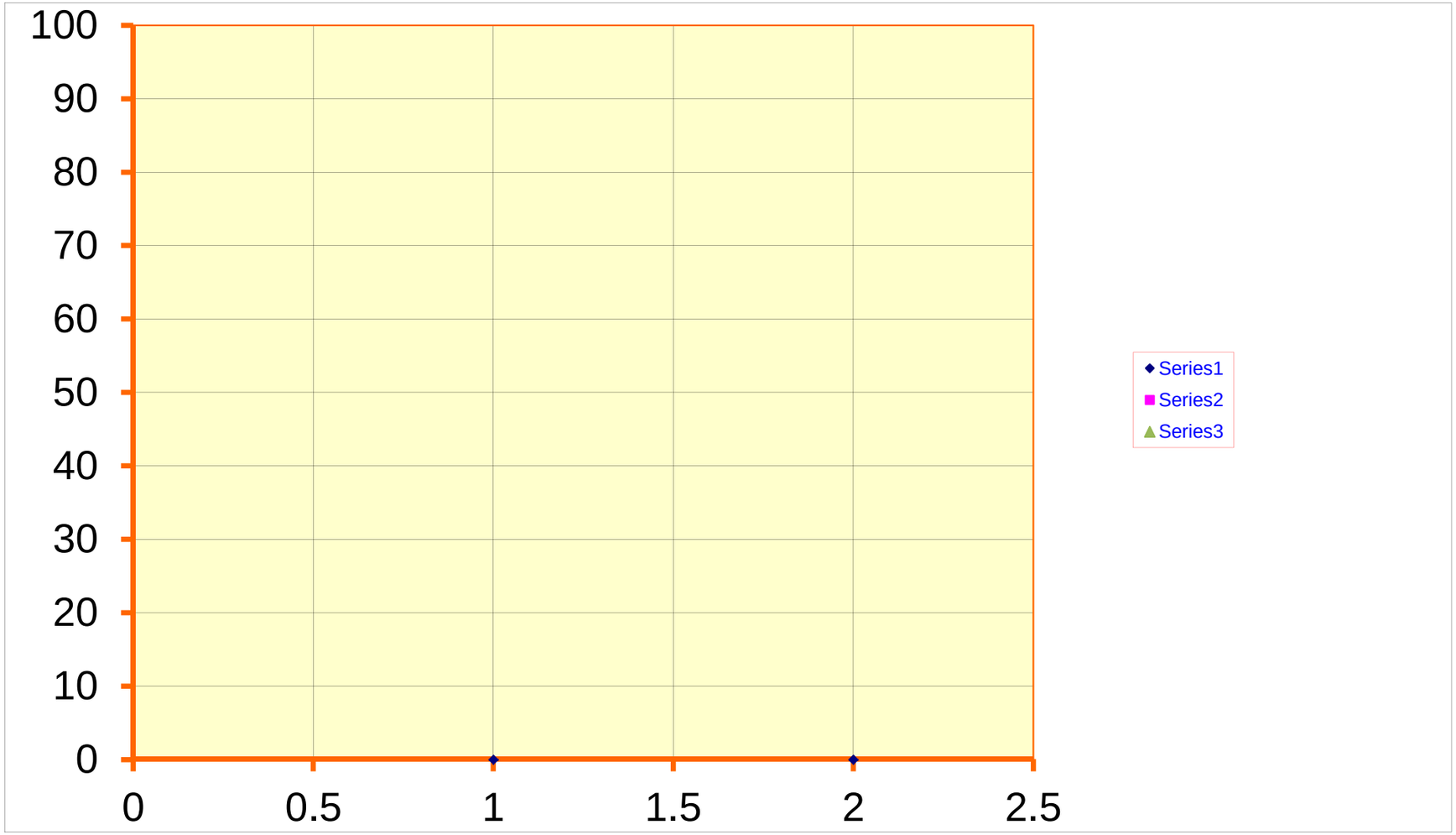
You may need to hold the "Control" key to select multiple columns of data.



Triangular Grid Node Coordinates

	Xi (Even Row)	Xi (Odd Row)	Yi
-10			
-9			
-8			
-7			
-6			
-5			
-4			
-3			
-2			
-1	2683113.7	2683117.1	216036.6
0	2683120.4	2683123.8	216042.4
1	2683127.1	2683130.5	216048.2
2	2683133.8		216054.0
3			
4			
5			
6			
7			
8			
9			
10			

APPENDIX B

FIELD PROCEDURES

APPENDIX B
FIELD PROCEDURES
AOI 5 WORK PLAN FOR REMEDIAL EXCAVATION
PES FACILITY
PHILADELPHIA, PENNSYLVANIA

B.3. SOIL SAMPLING & WELL INSTALLATION

Responsible Personnel: Geologist

Training Qualifications: All field personnel supervising drilling activities shall have completed OSHA 40-Hour training, Basic Orientation Plus raining, and three days of field training. Personnel supervising the well installation shall have observed drilling procedures for a minimum of three under the direct supervision of experienced personnel. Field personnel will have experience in operating the following field equipment: interface probe and photo-ionization detector (PID). Personnel should be able to describe soils encountered during drilling for generation of well logs.

Health and Safety Requirements:

A site specific HASP must be completed and reviewed by all field personnel. Prior to deploying equipment to the site, a utility call must be made (i.e. Pennsylvania One-Call) to allow mark-out of known subsurface utilities and associated laterals proximal to the site. Site plans, if available, should be reviewed to document and avoid the location of on-site utilities. No drilling should occur on retails sites within the exclusion zone. This zone is defined as the area between the pumps, the tank field and the station building. The area is excluded from drilling activities due to the likely occurrence of subsurface petroleum distribution lines. After review of all known mapped and marked utilities, a site reconnaissance will be performed to document the location of utility meters and storm sewer drains. In addition, the location of overhead utilities must be documented. After completing the subsurface and overhead utility review, the area to drill may be observed as clear or the location may be adjusted to a "clear" location.

Once the boring location is established, the area must be marked with cones to alert area traffic of the work area. Other health and safety concerns include slip/trip hazards, working with heavy equipment and overhead work hazards. During drilling activities, a minimum of protective work gloves, steel toed boots, hard hats, and safety goggles must be worn.

Decontamination Requirements:

All down-hole and soil sampling equipment must be cleaned with detergent and rinsed with distilled water prior to deployment into the borehole.

1) Borehole Advancement

During soil sampling or well installation activities, a borehole is advanced into the unconsolidated subsurface materials by means of a decontaminated stainless steel or aluminum hand auger.

2) Soil Sampling

Soil samples will be obtained for lithologic logging and laboratory analysis for chemical contaminants with a decontaminated stainless steel hand auger or trowel. The sampling device is advanced into undisturbed sediments below the auger bit. In the case of soil stockpiles, a decontaminated, stainless steel hand trowel will be utilized to collect and composite soil samples. With the hand auger, soil samples will be collected from the desired interval by removing the soil column that is contained in the auger portion of the device at intervals which appear to be visually impacted or from intervals which exhibit the highest deflections on the screening device (PID or similar).

Documentation:

All site activities should be detailed in the site investigators fieldbook. The entry shall include the date, time, weather, address, and persons present on-site. In addition, data required to create well construction logs or boring logs (if no well is constructed) should be collected. This data includes soil type, relative moisture content, depth of water table, observed impact, soil screening measurements (if PID is used), sample recovery, and depth of borehole. The site investigator should identify the relative location and number.